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ON THE MOLLUSK FAUNA OF THE LAND-LOCKED WATERS OF BERMUDA[1]

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The land-locked waters of Bermuda are sink-holes filled with ocean water, ponds in the fresh-water marshes, drainage canals, or cemented tanks in gardens. The location of the places studied was gathered from the six sheets of the Ordnance Map of Bermuda, 1:10560. Three stays on Bermuda in the summer months of the years 1947, 1948, and 1950 provided ample opportunity to visit and revisit the localities listed below. My thanks are due to the Bermuda Biological Station for Research and especially to the general manager, Mr. A. E. Ball, for information and for obtaining permission for me to work on private property. My young friend, Mr. Noel Burland, of Balholm Cottage, Point Shares, Pembroke, Bermuda, was actively helpful.

The localities visited are as follows:

St. George's Parish: (1) Lily pond in the biological station; (2) Lovers Lake, St. George's West.

Hamilton Parish: (3) Davis Pond, Crawl Hill, Bailey's Bay; (4) pond on Racecourse near The Flatts; (5) water hole on the Racecourse; Eve's Pond, between Racecourse and The Flatts, below Somers Hill (drained and dried out); (6) pond on Walsingham estate, near Cripple Gate; (7) Trotts Pond, near Tuckers Town; pond, about half a mile northeast of Trotts Pond (brackish, but polluted and almost filled up by dumping); (8) Mangrove Lake, near Tuckers Town.

Devonshire Parish: (9) Devonshire Marsh and its ditches (drained and almost dry since 1950).

Pembroke Parish: (10) Pembroke Marsh. (The western portion was already drained and dried out in 1947; the eastern portion is being filled up with city dump from Hamilton and was almost dried out in 1950, its drainage canal being somewhat polluted.)

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[1] The Bermuda Biological Station, Contribution No. 181.

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Smith Parish: (11) Spittal Pond.

Paget Parish: (12) Paget Marsh and its ditches.

Warwick Parish: (13) Warwick Pond.

Southampton Parish: (14) Seymour's Pond.

Walsingham Pond, near Tom Moore's Tavern, Hamilton Parish, well known to contain ocean water with an exceedingly rich marine fauna, was not included in this list.

The reclaiming of the fresh-water marshes for agricultural purposes and their drying out as the result of such draining, together with the increasing pollution of the still remaining accumulations of fresh water, will make an end to the few truly fluviatile mollusks of Bermuda that are endemic. Only the few hardy, introduced species, and the prosobranchiate *Hydrobia bermudensis,* with its great toleration of brackish water, will be left within the near future. Thus I consider it fortunate that I could collect some last minute records of an apparently doomed fauna.

Almost our entire knowledge of the fresh and brackish water mollusks of Bermuda rests on two publications: that of Vanatta (1910) and that of Peile (1926). According to these authors, the fresh-water malacofauna of Bermuda consists of the following species (localities in parentheses):

Physa caliban Vanatta (Pembroke Marsh near Hamilton).

Planorbis uliginosus Vanatta (Pembroke Marsh near Hamilton).

Planorbis imus Vanatta (collected in "Bermuda").

Ancylus (Ferrissia) bermudensis Vanatta (a ditch in Pembroke Marsh).

Paludestrina bermudensis Pilsbry (a ditch in Pembroke Marsh).

Pisidium volutabundum Vanatta (Pembroke Marsh).

All the species described from the Pembroke Marsh area and listed above have been found again in the course of my collecting, both at the original locality and in new ones. I was unable, however, to find *Planorbis imus,* said by W. M. Rankin to have been found in "Bermuda." Our only knowledge of this form rests on Vanatta's original description. F. C. Baker, who knew this form only from the description, lists it (1945, p. 182, pl. 123, figs. 29–30) under the name of *Promenetus imus.* On account of the rather vague indication of provenience and of the fact that this species has never again been found in Bermuda, I am inclined to doubt that it occurred in Bermuda at all and to suppose that some error of museum records is to blame.

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I was able to discover some recently imported and not yet recorded additions to the Bermuda fauna: namely, the lymnaeid *Pseudosuccinea columella* Say, from the mainland of North America, and the planorbid *Austroplanorbis bahiensis* Dunker, from northeastern South America.

MOLLUSKS FOUND IN OR AROUND LOVERS LAKE, ST. GEORGE'S PARISH

Lovers Lake, situated near the extreme west of St. George's Island and within easy walking distance of headquarters in the Bermuda Biological Station for Research, was frequently visited, since I found that it constitutes a biotope of considerable interest. The lake, a vast sink-hole, is of a roughly oval shape, about 450 feet long and 200 feet wide. It is separated from the ocean by a land bridge about 220 feet wide. Lovers Lake carries a table of very slightly brackish water (density at 70° F.: 1022) on the ocean water filling the basin by subterranean channels, so that the fresh-water surface rises and falls with the tides. Despite the presence of tides in the lake, there seems to be little or no circulation in the water, which is thus rather poor in oxygen, a feature shown by the scarcity of marine life in it; only a few marine species, some mollusks among them, are found in moderate numbers. The thin table of fresh water, fresh enough to serve as water for cattle and other domesticated animals, is almost devoid of animal life; the fresh or brackish water fish *Fundulus bermudae* Miller lives here. Only one species of mollusk could be detected.

Mangrove grows all around on the margins of the lake. Its shores slope more or less gently toward the water. Under the smaller rocks of coral sandstone lying on or slightly imbedded in the ground, a few of the smaller land shells of Bermuda were collected, whereas under similar rocks lying closer to the water and reaching close to or just into its high tide level, quite a community of ellobiid snails prospers. Among these the elsewhere common *Melampus coffeus* Linnaeus is missing. Strangely enough, a marine bivalve of the genus *Lasaea* that can stand periodical exposure at low tide is present in great numbers; the species in question, however, *L. bermudensis* Bush, is apparently never covered by the water—just moistened by it—and this water is fresh or very slightly brackish, not oceanic!

Very similar conditions are found in other land-locked ponds of sea water, as in Davis Pond, Trotts Pond, and Mangrove Lake, but the fresh-water table on these basins is negligible or entirely missing.

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Marine mollusks found in Lovers Lake were the following:

Batillaria (Lampanella) minima Gmelin.

Cythara (Mangelia) accincta Montagu.

Hima (Hima) ambigua Montagu.

Columbella (Nitidella) cribraria Lamarck.

Codakia (Jagonia) orbiculata Montagu.

This species was found in the fresh-water table of Lovers Lake but was very scarce:

Hydrobia (Hydrobia) bermudensis Pilsbry.

Found at or near high tide level in Lovers Lake were: *Alexia (Myosotella) myosotis bermudensis* H. and A. Adams.

Melampus (Microtralia) occidentalis Pfeiffer. This is *Auriculastra nana* described by myself (Haas, 1950, p. 197, pl. 22, figs. 1, 2), as pointed out to me by Dr. J. P. E. Morrison.

Blauneria heteroclita Montagu.

Pedipes ovalis C. B. Adams. This is, according to Morrison, my *Pedipes insularis* (Haas, 1950, p. 197, pl. 22, fig. 3).

Laemodonta (Bullapex) cubensis Pfeiffer.

Truncatella (Truncatella) bilabiata Pfeiffer.

Truncatella (Truncatella) pulchella Pfeiffer.

Assiminea (Assiminea) succincta Pfeiffer.

Lasaea bermudensis Bush.

Land mollusks collected on the shore of Lovers Lake were:

Helicina (Helicina) fasciata convexa Pfeiffer.

Gastrocopta (Gastrocopta) barbadensis Pfeiffer.

Gastrocopta (Gastrocopta) pellucida hordeacella Pilsbry.

Opeas (Opeas) gracile Hutton.

Opeas (Opeas) micrum Orbigny.

Lacteoluna hypolepta Shuttleworth.

FRESH-WATER MOLLUSKS FOUND IN BERMUDA

Of the fourteen inland water basins visited in Bermuda and listed on page 101, only eight (numbers 1, 5, 9–14) contained fresh or comparatively fresh water. The species collected and the localities are as follows:

Pseudosuccinea columella Say. Lily pond in the Bermuda Biological Station for Research; Pembroke Marsh near Hamilton; Devonshire Marsh. First record of this species from Bermuda.

Physa caliban Vanatta. Devonshire Marsh; Pembroke Marsh; Paget Marsh.

Hippeutis (*Menetus*) *uliginosus* Vanatta. Devonshire Marsh (rare).

Australorbis bahiensis Dunker. Pembroke Marsh and its drainage canal. First record for Bermuda.

Ferrissia (*Ferrissia*) *bermudensis* Vanatta. Pembroke Marsh (rare).

Hydrobia (*Hydrobia*) *bermudensis* Pilsbry. Lovers Lake; Racecourse; Spittal Pond; ditches in Paget Marsh; Warwick Pond; Seymour's Pond. Plentiful everywhere but in Lovers Lake.

Pisidium volutabundum Vanatta. Pembroke Marsh; Devonshire Marsh (rare).

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